

ACCLIMATION/ADAPTATION OF CORAL REEFS IN A MARGINAL ENVIRONMENT

R.P.M. Bak (NIOZ/UvA), Meesters, E.H. (NIOZ), G. Nieuwland (NIOZ), Suharsono (LIPI)

Background

Coral reefs are known to flourish in clear waters, but reefs do occur in turbid conditions. Turbidity and increased sedimentation decrease the amount of substratum that is available for settlement of larvae. High sediment loads may increase mortality of coral colonies. Reduced irradiance may affect the energy balance of the coral-algal association.



Fig 1

Objective

To describe relevant biological characteristics of reefs in marginal environmental conditions. Turbidity and sedimentation are factors of world-wide importance in degrading reef environments to marginal conditions, a consequence of increasing pressure from human populations in the coastal zone.

Methods

We measured turbidity, sedimentation, resuspension, light irradiance and assessed coral communities in 4 islands (Fig 1) along an inshore to offshore gradient through Teluk Banten. Coral species presence, cover, numbers of coral recruits, partial mortality, was determined at three depths: shallow, intermediate and deep, representing reef terrace, upper reef slope and lower reef slope.

To investigate a possible effect of adverse environmental conditions on the coral organism we looked for an indicator of coral metabolic functioning. RNA/DNA ratio would provide an index of protein synthetic capacity per cell and provide an estimate of growth rate and metabolic status. We measured RNA/DNA ratios in corals (massive *Porites* species) along two gradients: in relation with depth over the reef slope and with increased turbidity between sites (Fig 2).

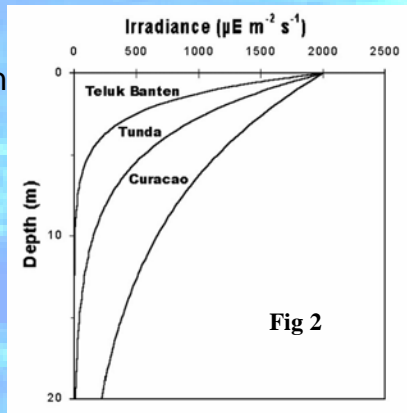


Fig 2

Results

Resuspension of bottom sediment was important in preventing negative effects of sedimentation (Fig 3). There was a significant increase in suspended particle concentration with depth. Gosong Dadapan has highest levels of SPM (Fig 4). Living coral cover was high and decreased with depth (Fig 5). The depth distribution of corals is primarily limited by the ambient light regime, and coral reefs become 'compressed' as water clarity decreases.

A total number of 83 scleractinian species were identified. Partial mortality (Fig 6) shows no significant relation with depth. The two islands closest to shore have a much higher partial mortality than the two outer islands. Asexual recruitment was the most abundant mode of recruitment (89.5 % of all recruits) but sexual recruits occurred throughout the bay.

RNA/DNA ratios varied with the environment, RNA/DNA ratios were negatively correlated with depth (Fig 7), except over the short reef slope in extremely turbid Dadapan Gosong (Fig 4). The relationship between the RNA/DNA ratio and light is consistently different under turbid conditions. RNA/DNA ratios have shifted to a higher level, possibly indicating a genetic adaptation in the metabolic functioning of corals in the turbid environment (Fig 8).

Conclusions

Coral reefs can thrive in the marginal environment of Banten Bay, the coral community appears acclimated to the conditions. Abundant partial mortality and subsequent asexual recruitment may be an aspect of such adjustment. We suggest that the corals are possibly adapted to such turbid low light environments. The RNA/DNA ratio appears a promising method to determine the metabolic functioning (health) of coral colonies.

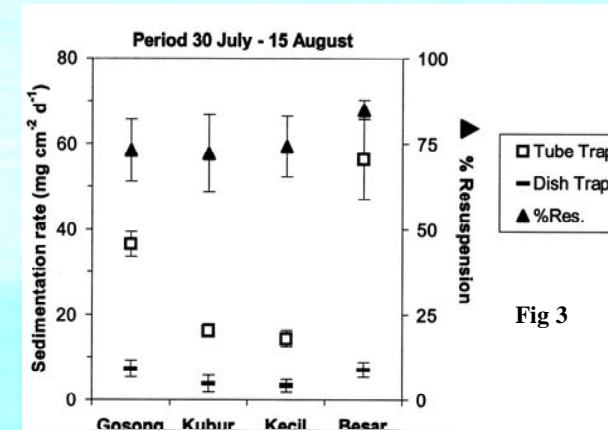


Fig 3

Sedimentation and resuspension

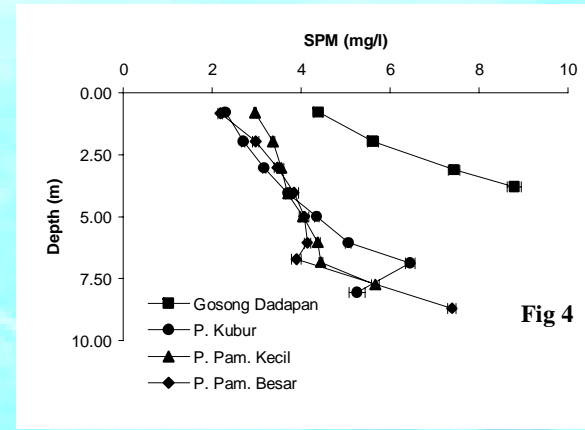


Fig 4

Concentration of suspended particulate matter with depth

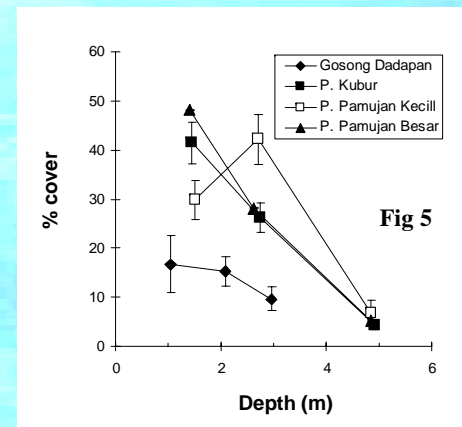


Fig 5

Living coral cover at different depths

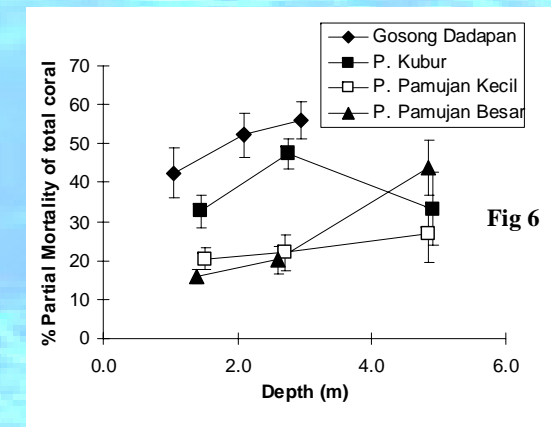


Fig 6

Partial mortality at different depths

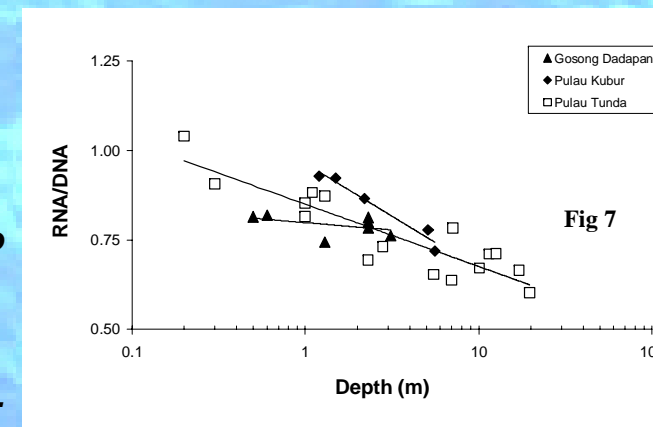


Fig 7

RNA/DNA ratios with sampling depth at two bay study sites and offshore site. Note logarithmic scale of x-axis.

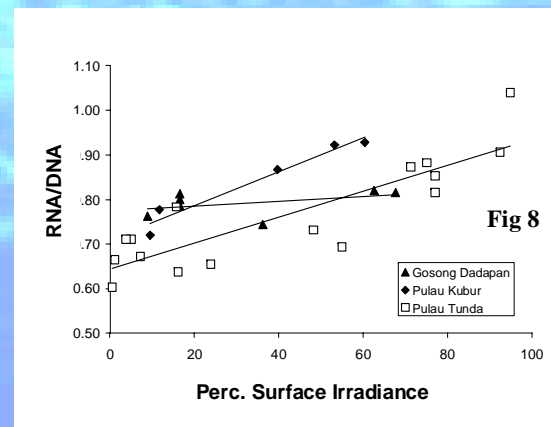


Fig 8

RNA/DNA ratio versus light inside and outside of Banten Bay.